CCS Technical Documentation
RH-27 Series Transceivers

Troubleshooting - RF (Part 2)

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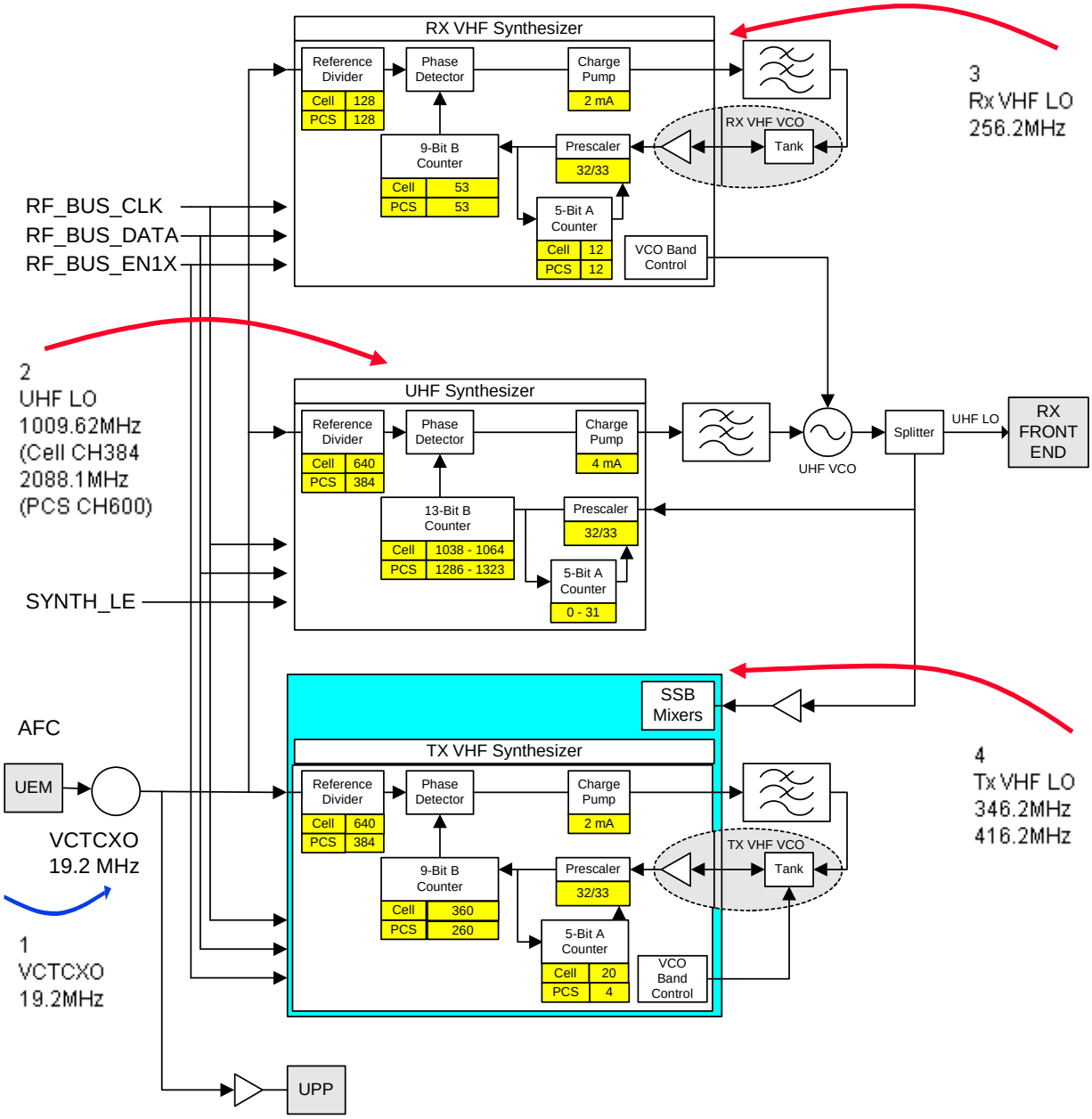
Synthesizer Troubleshooting



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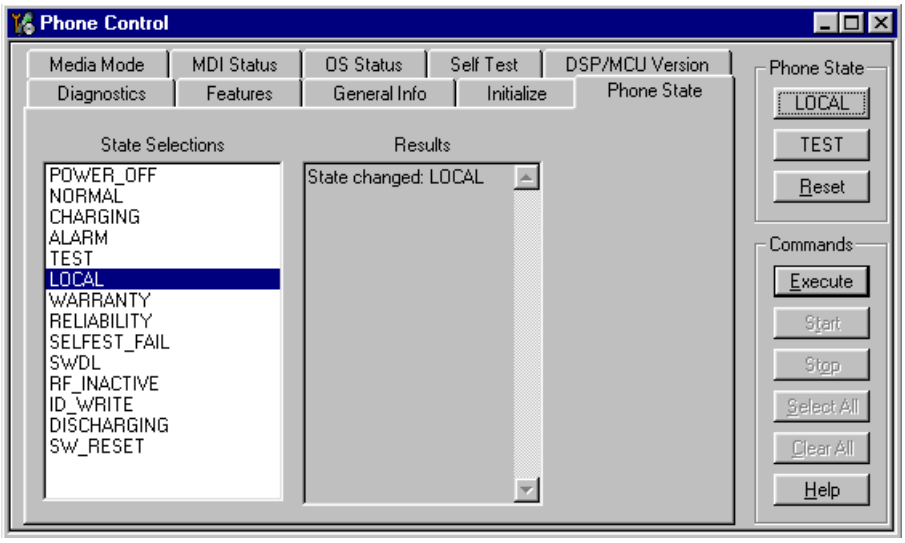
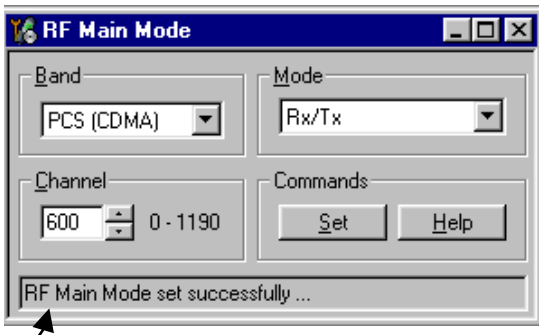
Synthesizer Setup Using Phoenix



1 Use Phone Control to put phone into Local Mode.

- UHF: Use RX/TX mode in PCS and CELL band. This allows for checking power to both RX and TX circuits. Typically, use CH 384 in CELL band and 600 in PCS band.
- RX VHF: Use RX mode, one band is enough.
- TX VHF: Use RX/TX mode, PCS and CELL band.



Make sure command was successful

2 Use RF Main Mode to set:

- Band
- Channel
- Rx/Tx mode

VCTCXO Troubleshooting

VCTCXO frequency is 19.2MHz. This is the reference signal. Without 19.2MHz, the phone

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will not power up. This signal goes to Batman, Robin, UHF PLL, and also to the UPP via a buffer amplifier (D572).

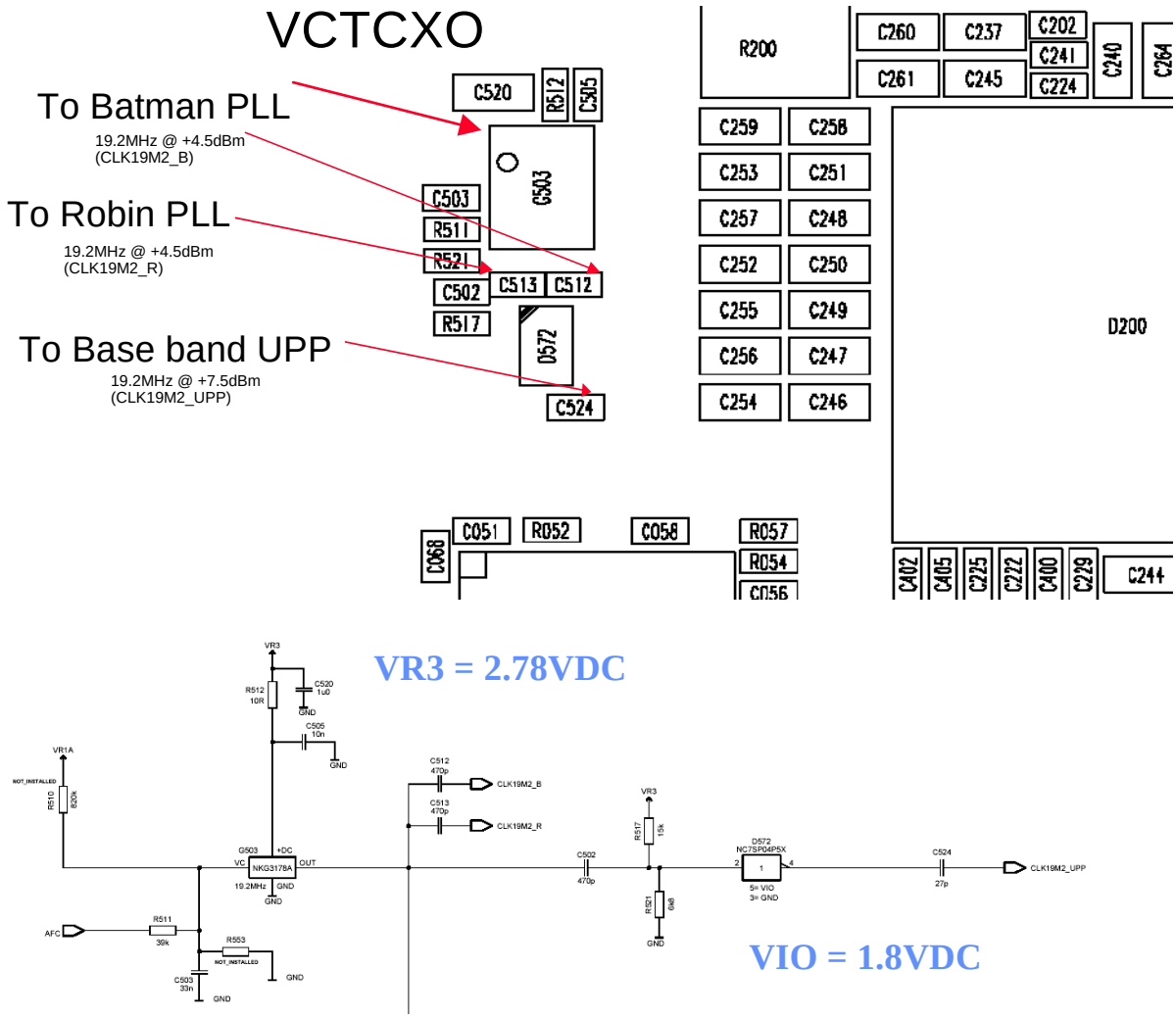
Check for the presence of the signal at the following points (use a high-impedance RF probe):

- CLK19M2_B, clock reference to Batman, should be +4.5dBm
- CLK19M2_R, clock reference to Robin, should be +4.5dBm
- CLK19M2_UPP, clock reference to UPP, should be +7.5dBm

(See the following figure for details)

If you do not see the VCTCXO signal at any of these points, check the voltages at the following supply lines:

- VR3, main supply line for VCTCXO circuitry, should be 2.78VDC
- VIO, supply line for buffer amplifier, should be 1.8VDC



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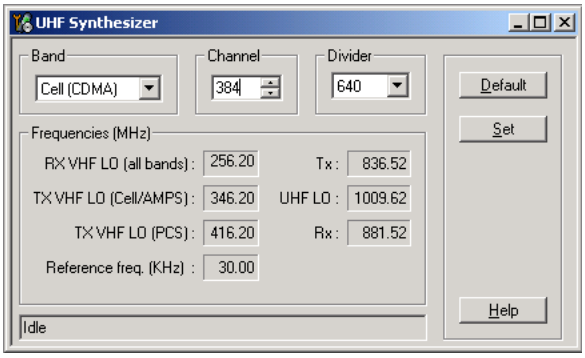
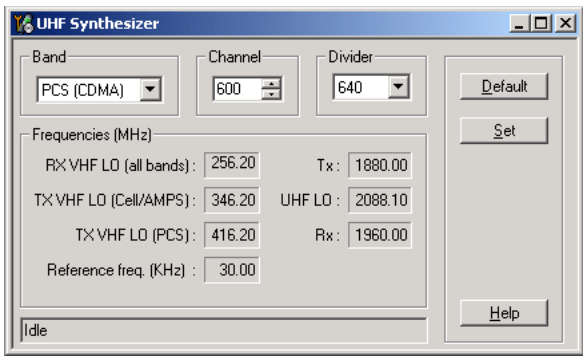
UHF Synthesizer Troubleshooting





UHF LO frequency varies with channel and can be quickly calculated using "UHF Synthesizer" Phoenix in RF menu.

Check to see if the LO is actually locked. Set a channel and check the status of the UHF LO within a very narrow span of 100KHz. You should see the LO virtually immobile.

Nominal UHF LO signal levels measured with RF probe (see the following figures).

If you do not see the presence of any LOs, check DC voltages at the following locations:

- R513, VR1A, supply line for UHF PLL IC. Should be 4.76VDC
- R515, VR4, supply line for VCO IC. Should be 2.76VDC

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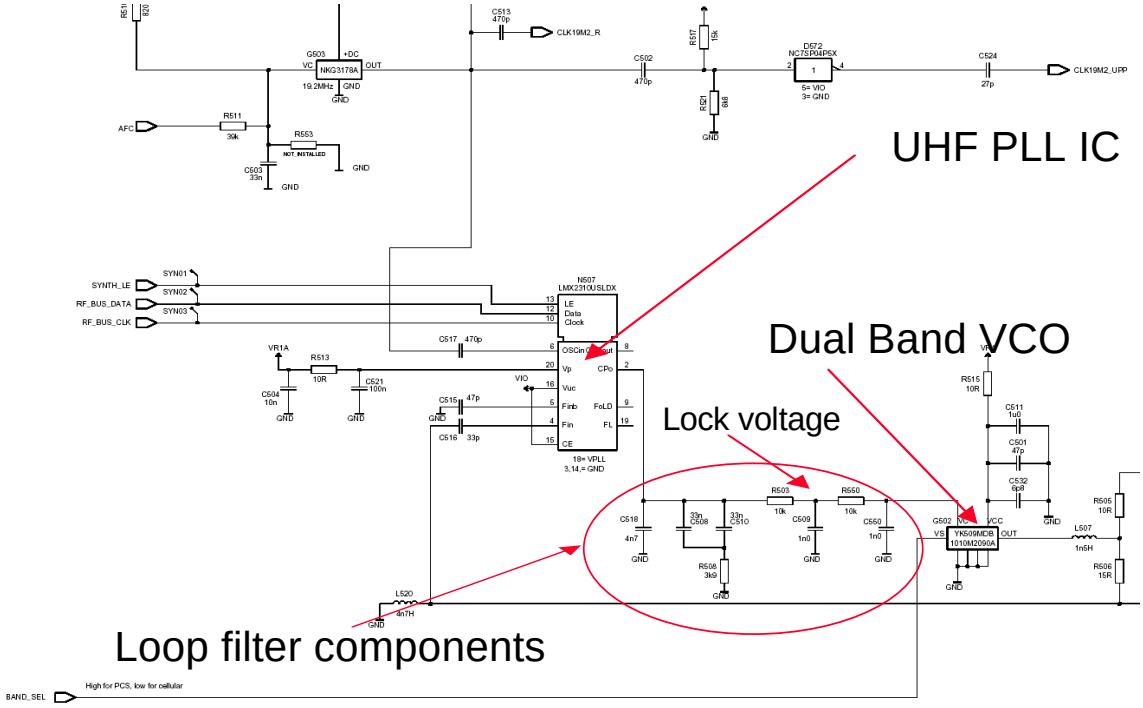
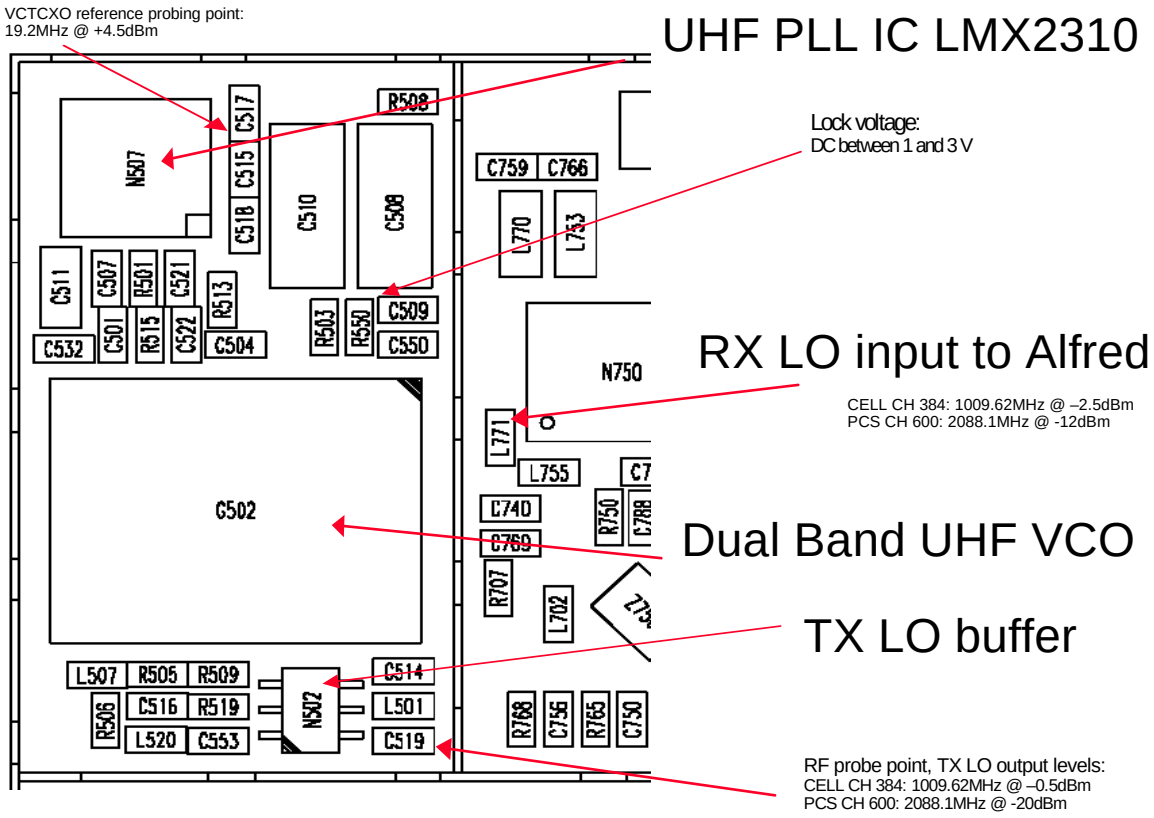
UHF Synthesizer Schematic



UHF Synthesizer Layout


VCTCXO reference probing point:
19.2MHz @ +4.5dBm
UHF PLL IC LMX2310
Lock voltage:
DC between 1 and 3 V
RX LO input to Alfred
CELL CH 384: 1009.62MHz @ –2.5dBm
PCS CH 600: 2088.1MHz @ -12dBm
Dual Band UHF VCO
TX LO buffer
RF probe point, TX LO output levels:
CELL CH 384: 1009.62MHz @ –0.5dBm
PCS CH 600: 2088.1MHz @ -20dBm

UHF Frequency is Incorrect

Possible causes:

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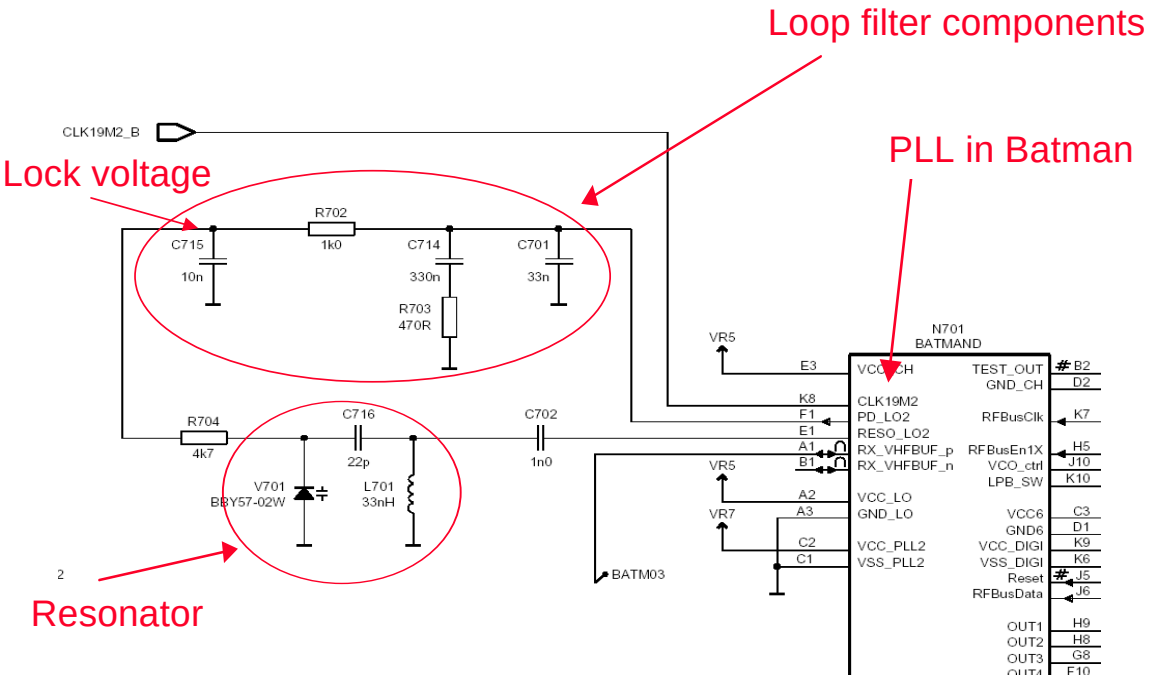
- Power supplies to PLL IC (N507) is missing or low.
- Loop filter components missing or incorrectly installed.
- 19.2MHz reference clock missing or low.
- Programming is incorrect.
- Component failure (VCO or PLL IC).

RX VHF (Batman LO) Schematic

- Operates at a fixed frequency of 256.2MHz. It is the second LO for down-conversion to I and Q for baseband processing. Refer to frequency plan.
- Monitor probing point at C702 for Batman LO. A locked and stable 256.2MHz with amplitude ~= -2.5dBm should be observed on the spectrum analyzer.
- Monitor control voltage at C715. The control voltage at locked state should be between 1.2 and 1.7VDV for the proper operation of Batman LO.



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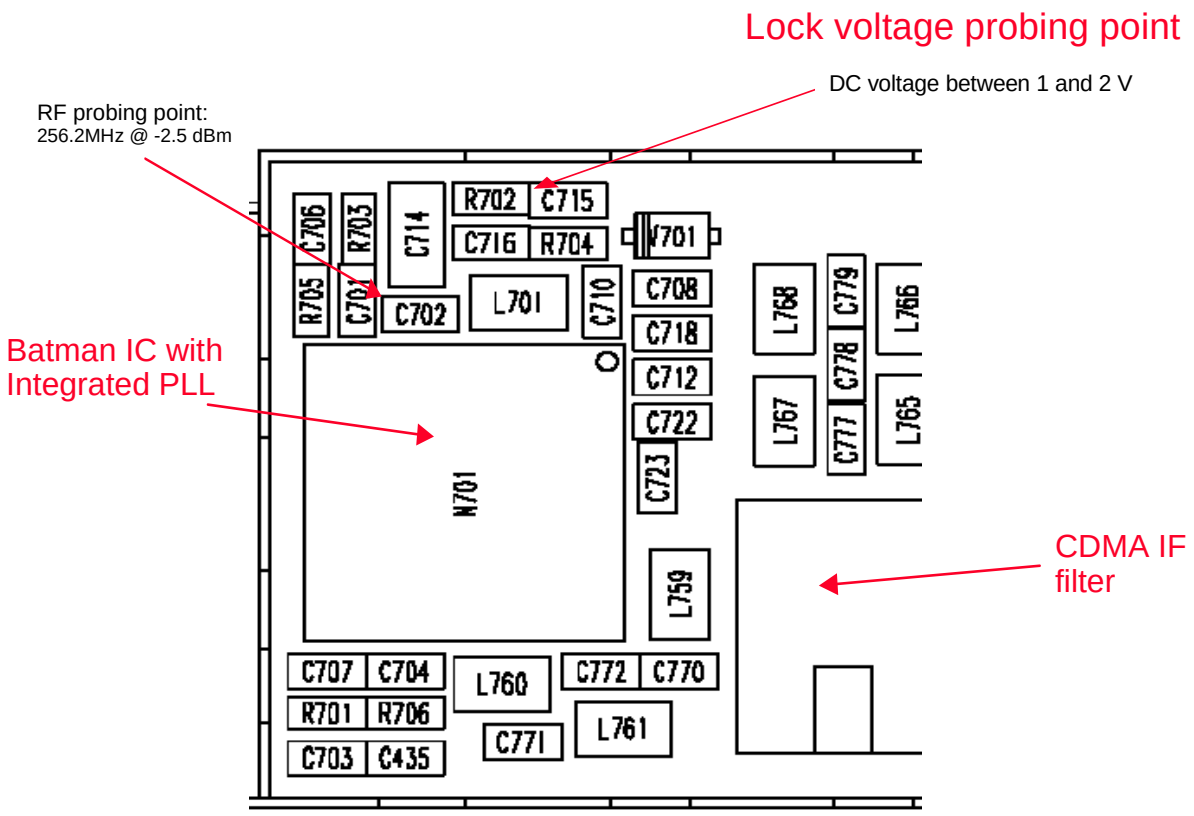
RX VHF Layout



Incorrect RX VHF Frequency

Possible causes:

- Power supplies to PLL portion of Batman IC (N701) missing or low (VR7).
- Loop filter or resonator components missing or incorrectly installed.
- 19.2MHz reference clock missing or low (C512).
- Programming is incorrect.
- Component failure (PLL IC).

TX VHF Schematic

- There are two fixed LOs — 346.2MHz for CELL band and 416.2MHz for PCS band. This is the first LO for up-conversion. Refer to frequency plan.
- Monitor probing point at C638 with a high-impedance RF probe for Robin LO. A sufficiently strong and stable signal should be observed on the spectrum analyzer.
- Monitor control voltage at C632. At this control voltage, the Robin LO is locked (it should be between 1.2 and 1.8VDC).

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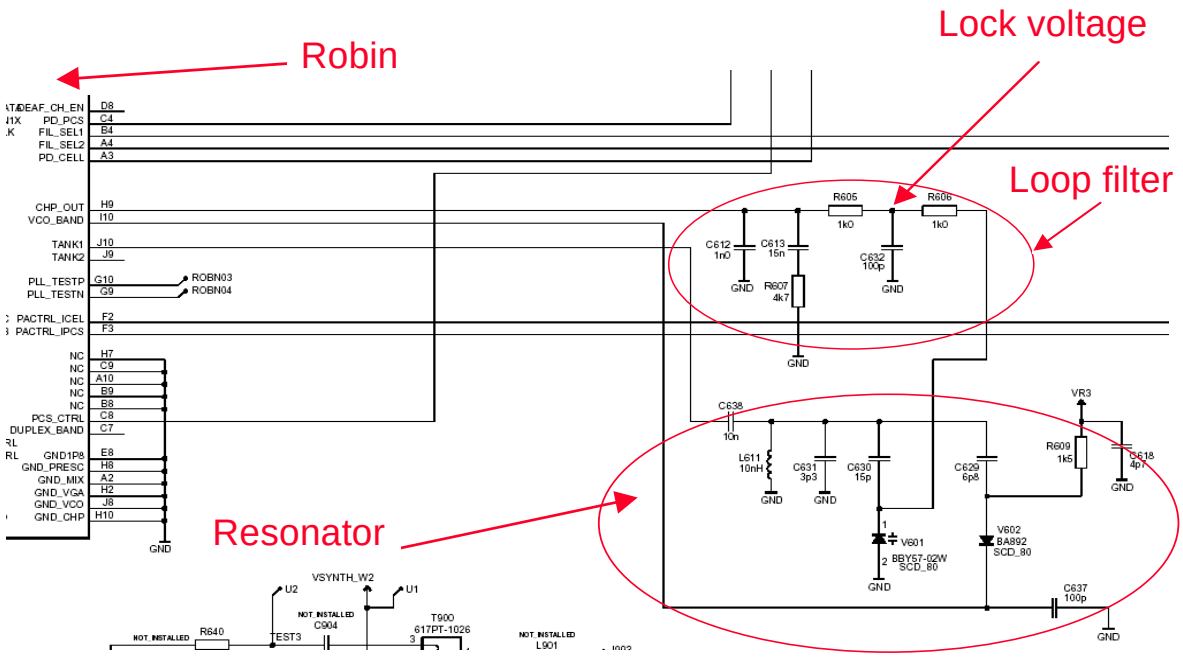
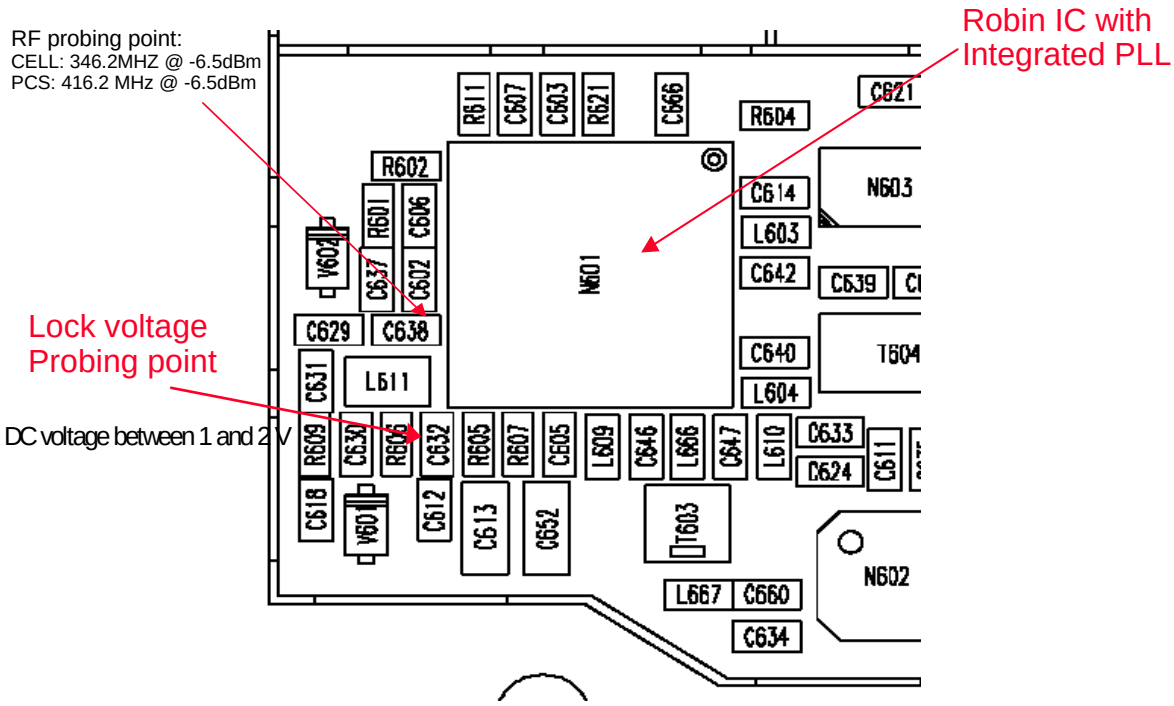


TX VHF Layout



Incorrect TX VHF Frequency

Possible causes:

- Power supplies to PLL portion of Robin IC (N601) missing or low (VR3).

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- Loop filter or resonator components missing or incorrectly installed.
- 19.2MHz reference clock missing or low.
- Programming is incorrect.
- Component failure (PLL IC).

TX Troubleshooting

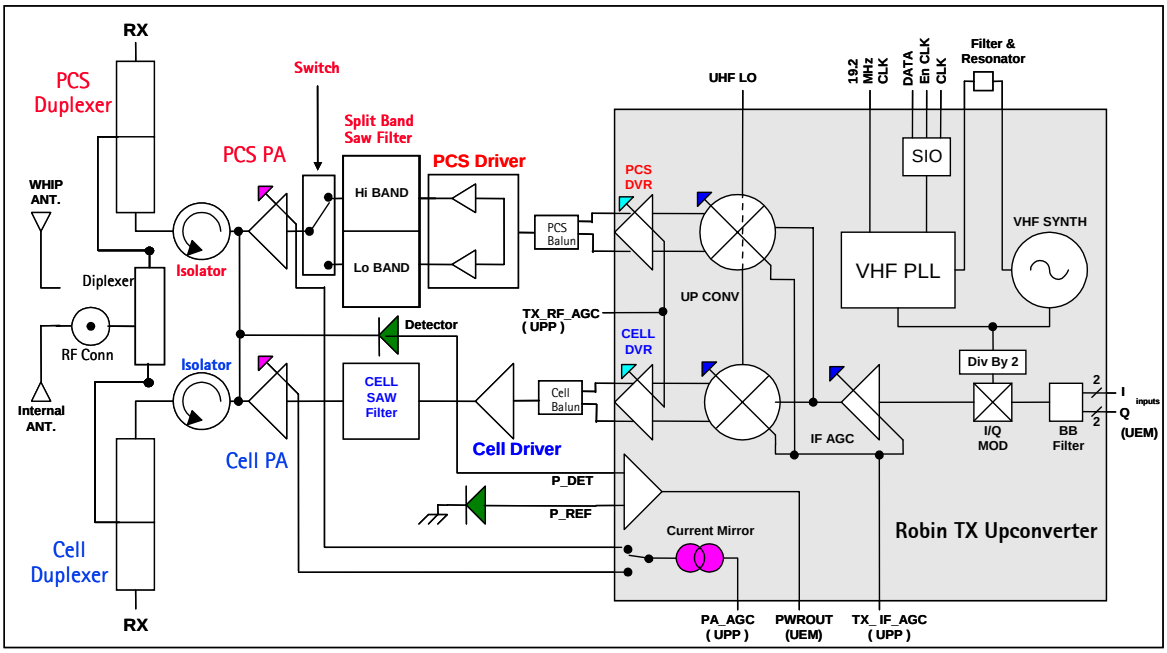

Figure 1: RH-27 TX system block diagram

- Setup phone in Local mode with appropriate band, channel, RHO, on and PDM settings.
- Agilent call box 8960 is recommended to measure TX power at RF connector.
- The numbers in the following diagram indicate the general RF signal flow and probing locations.
- More details are given in the following sections.

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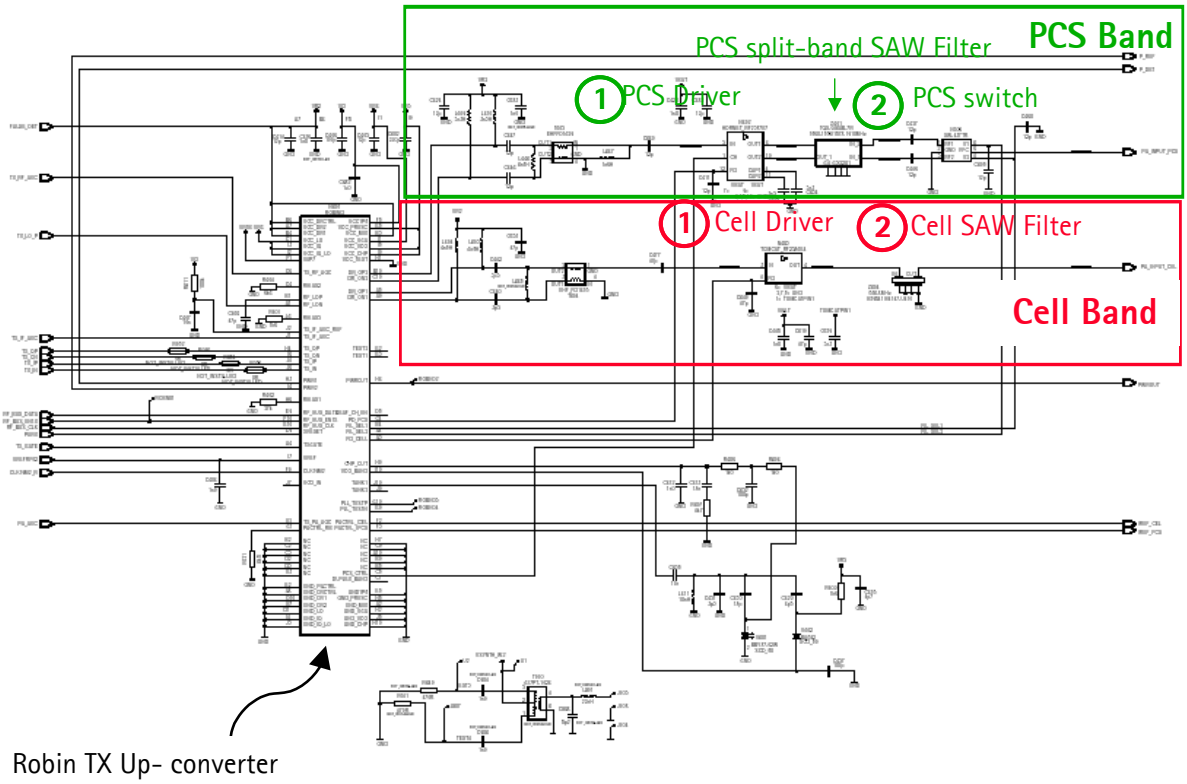
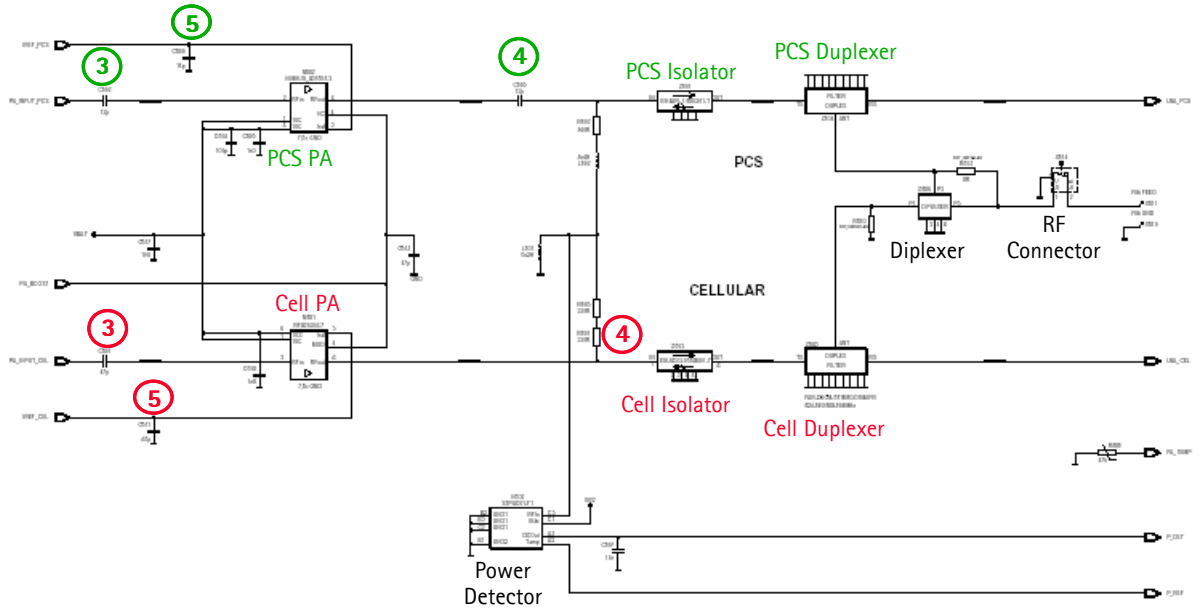
Transmitter Schematic 1



Transmitter Schematic 2



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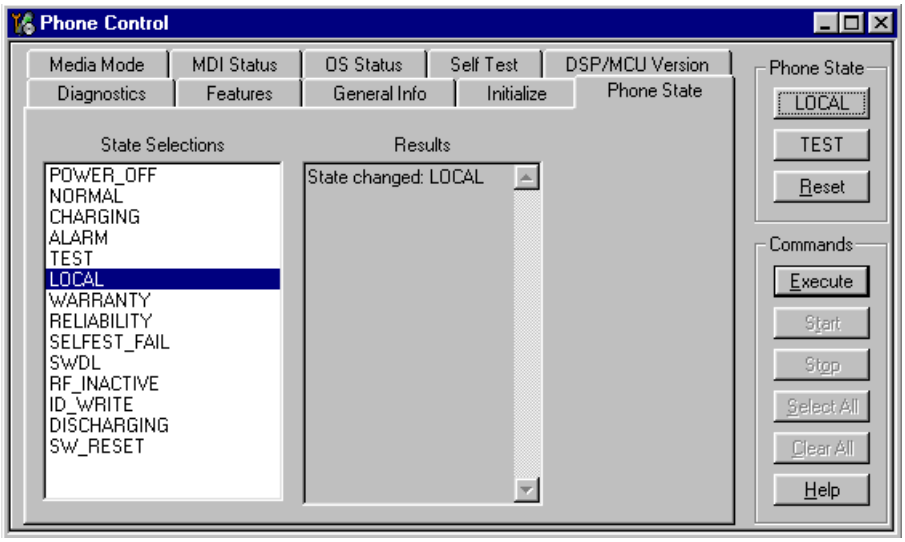
TX Troubleshooting Using Phoenix

1 Use Phone Control to turn phone on and select Phone State menu. Highlight "Local" and click the **Execute** button. This will put the phone into Local Mode



2 Use RF Main Mode to set:

- Band
- Channel
- Rx/Tx mode

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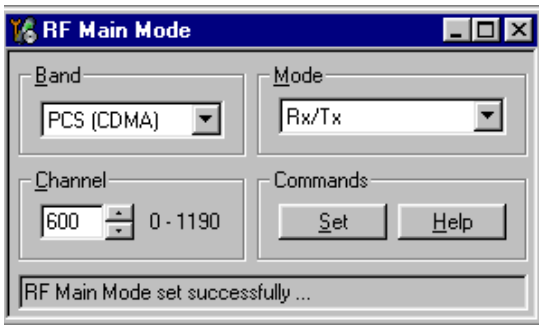
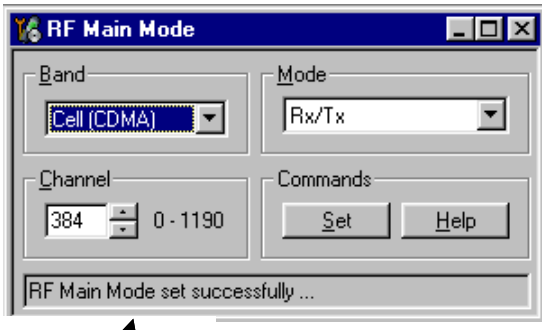


PCS Band

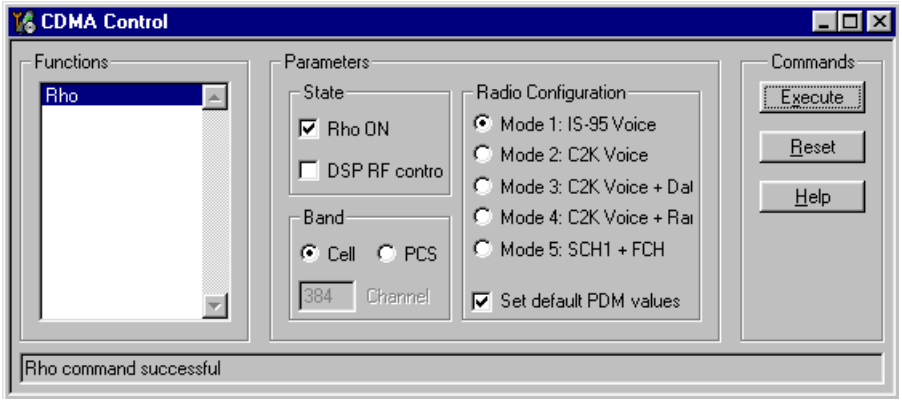


Cell Band

Make sure command was successful

3 Use CDMA Control under DSP menu

- Select "Rho ON" and click the **Execute** button.



Make sure command was successful

At this point you should be able to measure TX Pout at the RF connector using the 8960 Call Box.

Cell Band TX Pout = +11dBm

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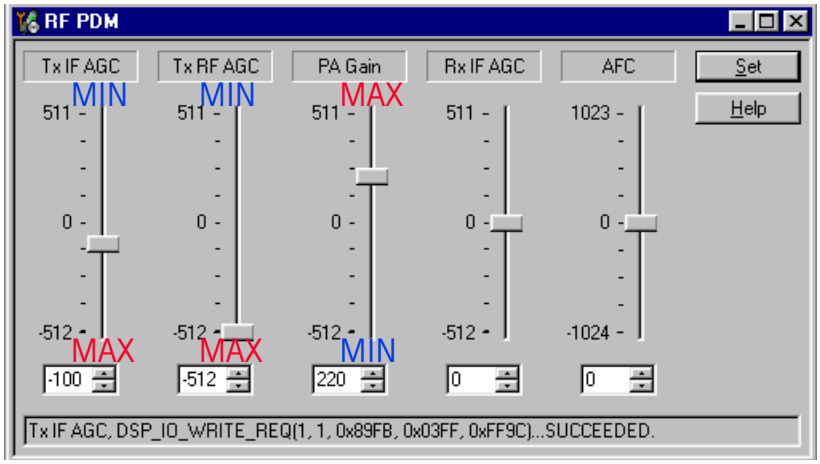
PCS Band TX Pout = +12dBm

If you don't see these powers, then it is time to start probing the TX path to find out where the signal stops.

4 After Local Mode/MainMode/and CDMA Control activated adjust the PDM values from under RF menu.



NOTE: If you do not measure the correct Tx power at the RF connector, then it is time to use the RF probe and determine where the failure occurs.

Local Mode Mode (either PCS chan 600 or Cell chan 384)

PA Gain PDM = +220
RF AGC PDM = -512
IF AGC PDM = -105 (PCS), -135 (Cell)

With PDMs set to the above values:

Phone TX Pout ≅ 23dBm (PCS)
Current ≅ 720mA (PCS)

Phone TX Pout ≅ 25dBm (Cell)
Current ≅ 880mA (Cell)

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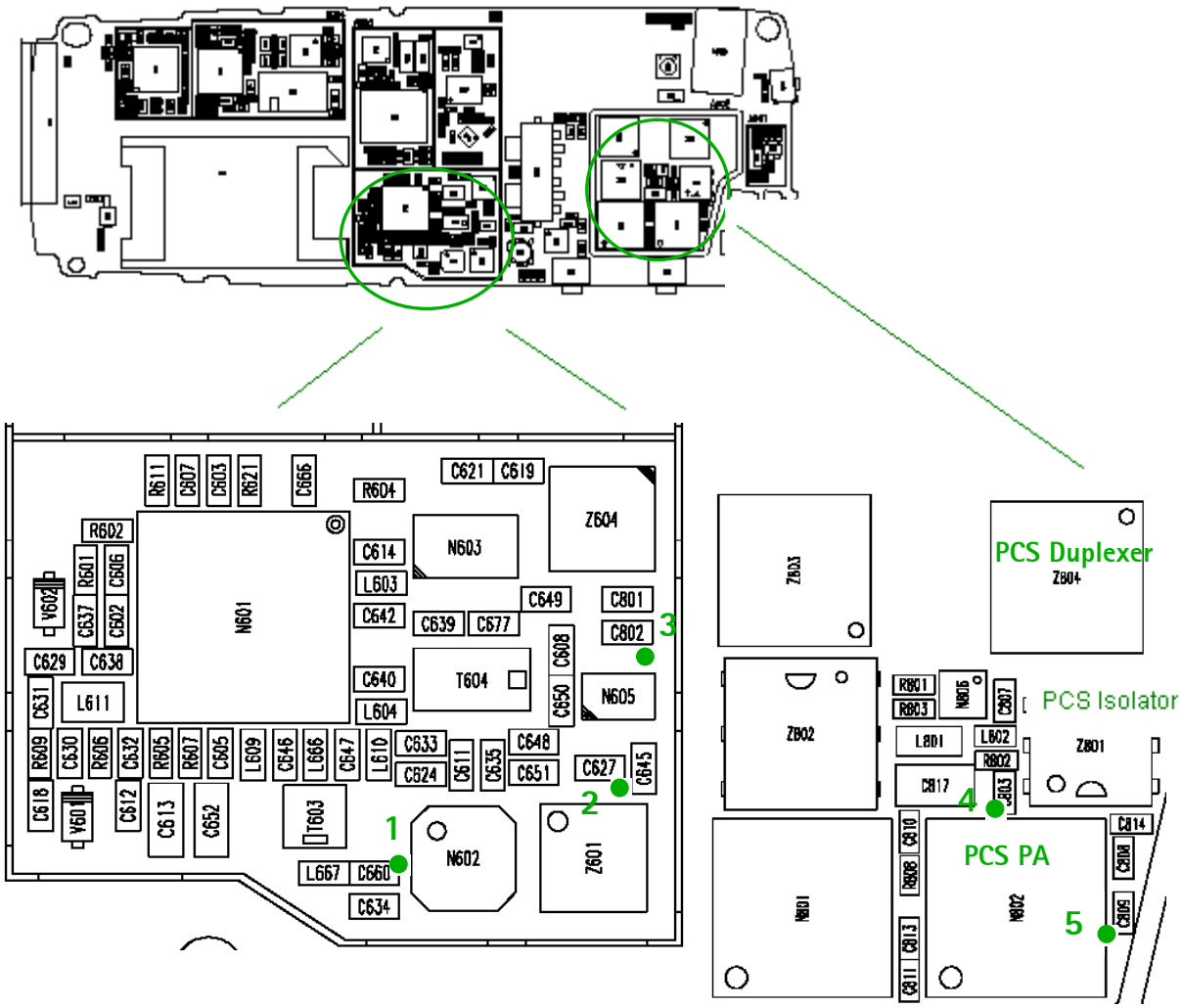
PCS Band TX Probe Points



Use PDM settings from previous section. Here are approximate power levels you should expect for PCS BAND (Channel 600)

1. C 660 Output of Robin (N601), input to Hornet (N602)
   Probed power ≅-2dBm (If not, then replace Robin)

2. C 627 Output of split-band filter (Z601)
   (Gain ≅10.5dB – (filter loss 2.3dB) ≅ 8.2dB)
   Probed power ≅ 7dBm (If not, then replace Hornet)

3. C 802 Output of the TX Switch (Loss ≅ 1dB)
   Probed power ≅ +6dBm (If not, then replace switch)

4. C 803 Output of PCS PA (use 10dB pad on probe or just sniff part)
   Probed power ≅ +18dBm (If not, then replace PCS PA)

5. C 809 IREF into PCS PA should be ≅ 2.7V (If not, trace back to Robin and then to BB)

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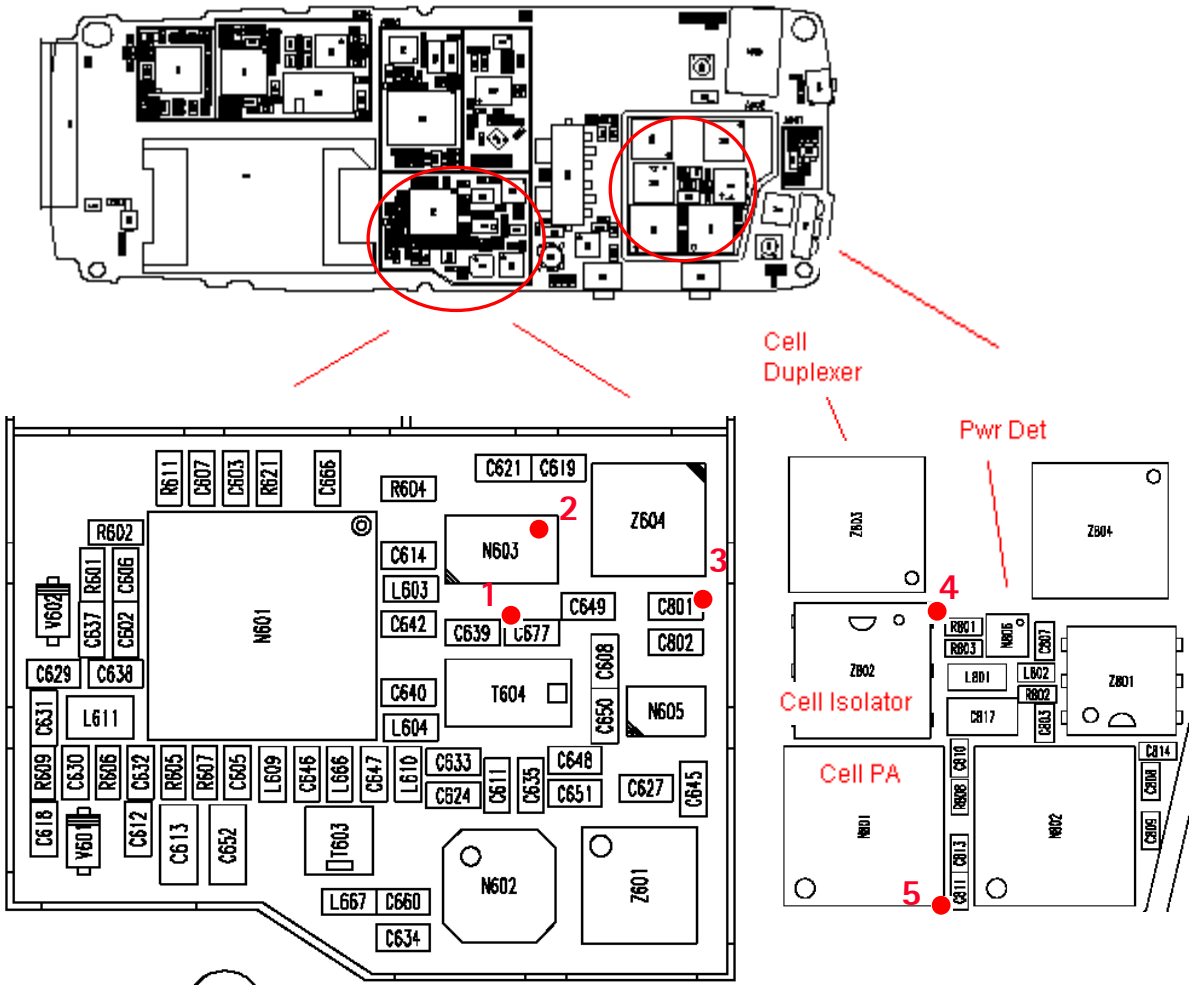
Cell and AMPS Band TX Probe Points



Use PDM settings from previous section. Here are approximate power levels you should expect for CELL BAND (Channel 384)

1. C 677 Output of Robin, Input to the Tomcat Driver
   Probed power ≅ -3dBm (If not, then replace Robin)

2. Pin 6 of Tomcat Driver is the output (Gain ≅ 14dB)
   Probed power ≅ +11dBm (If not, then replace Tomcat)

3. C 80 Output of the TX Saw filter (Loss ≅ 1dB)
   Probed power ≅ +10dBm (If not, then replace filter)

4. R 801 Output of Cell PA (use 10dB pad on probe or just sniff part)
   Probed power ≅ +21dBm (If not, then replace Cell PA)

5. C 811 IREF into Cell PA should be ≅ 2.7V (If not, then trace back to Robin and then to BB)

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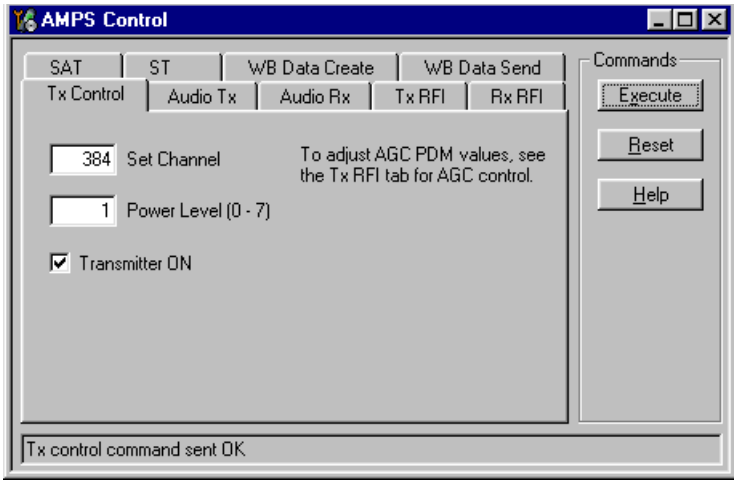
TX AMPS Troubleshooting Using Phoenix

- In Local Mode/MainMode select AMPS Band
  - Use PDM controls to adjust the PA, RF AND IF AGC



Local Mode Mode

PA Gain PDM = 229
RF AGC PDM = -416
IF AGC PDM = -137

With PDMs set to the above values:

Phone TX Pout ≅ +26dBm
Current ≅ 998mA

NOTE: If you do not measure the correct TX power at the RF connector, then repeat Cell band "Local" mode troubleshooting to find where the failure occurs. AMPS and Cell band share the same TX path.

RX Troubleshooting

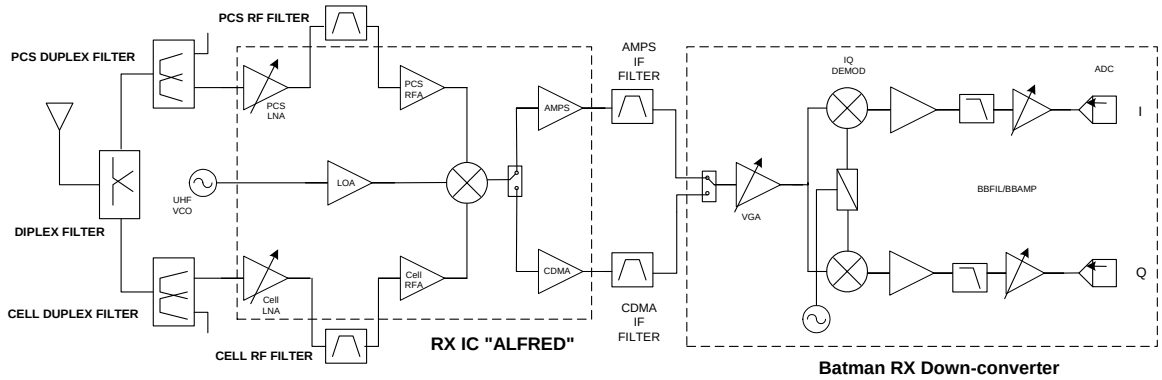


Figure 2: RH-27 RX system block diagram

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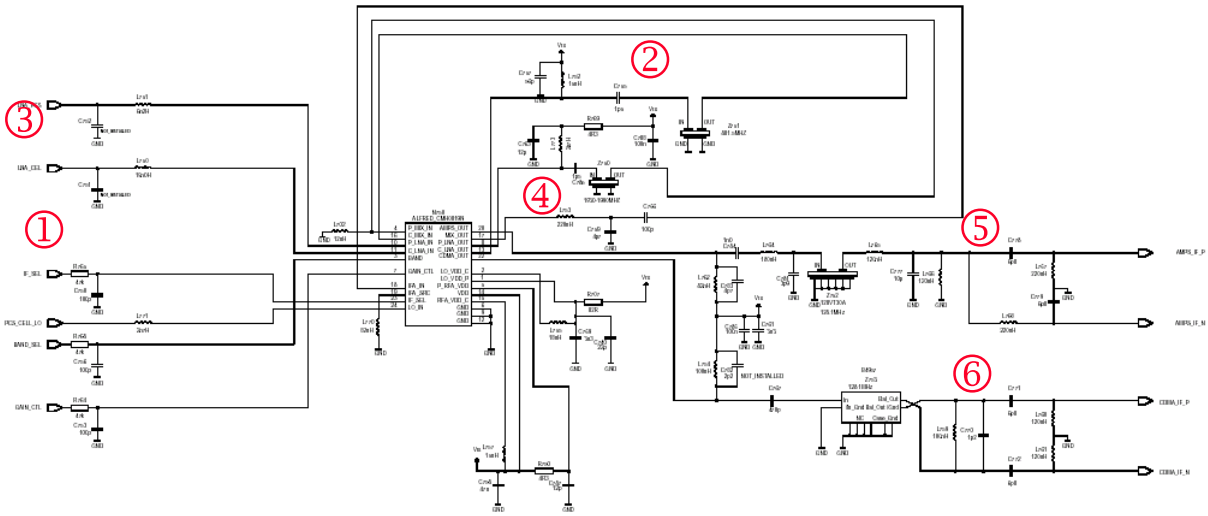
Receiver Schematic

- An external signal source is injected to the RF input. Signal is then traced throughout the receiver chains.
- Agilent call box 8960 is recommended. Hit Button "CALL SETUP", soft button "Active Cell" then select "CW".
- Inject a CW signal for PCS (1960MHz) or Cell/AMPS (881.52MHz) at a fixed –25dBm power level.

The numbers below indicate the general RF signal flow and probing locations. More details are shown in the following pages.



Turning on Rx Path Using Phoenix

- Turn on Receiver Only in CDMA Mode

Set to RX mode, Set band and Channel
PCS CH = 600, RX = 1960MHz
CELL CH = 384, RX = 881.52MHz
AMPS CH = 384, RX = 881.52MHz

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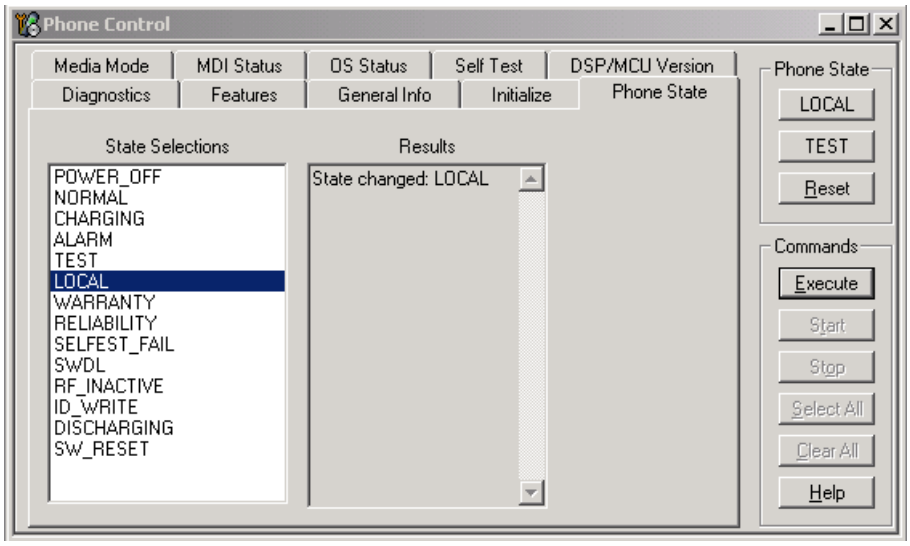
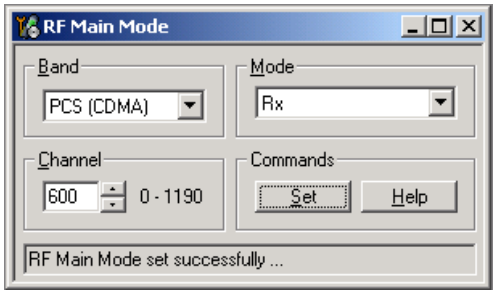
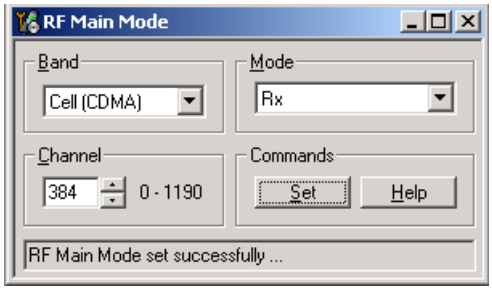
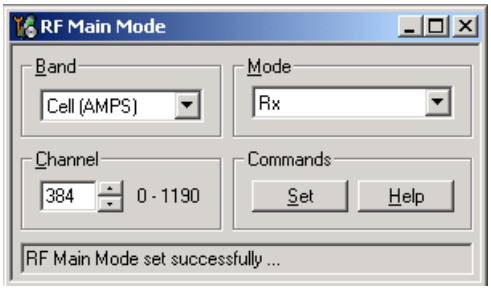




PCS
CH600
1960MHz



CELL
CH384
881.52MHz



AMPS
CH384
881.52MHz

Switching Rx Gain States Using Phoenix

- Two Gains (Hi and Lo) States are available in the receiver for CDMA and AMPS modes

Use RF Gen I/O (see the following)

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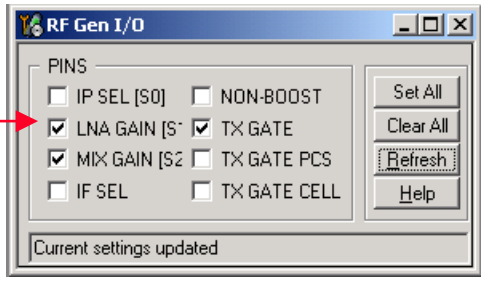
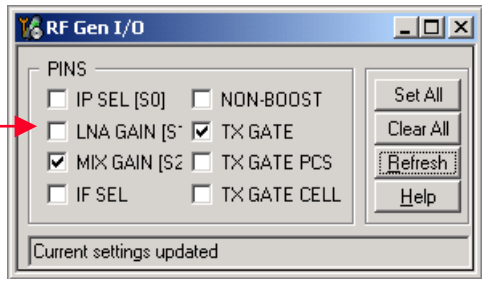
Hi Gain State



Lo Gain State



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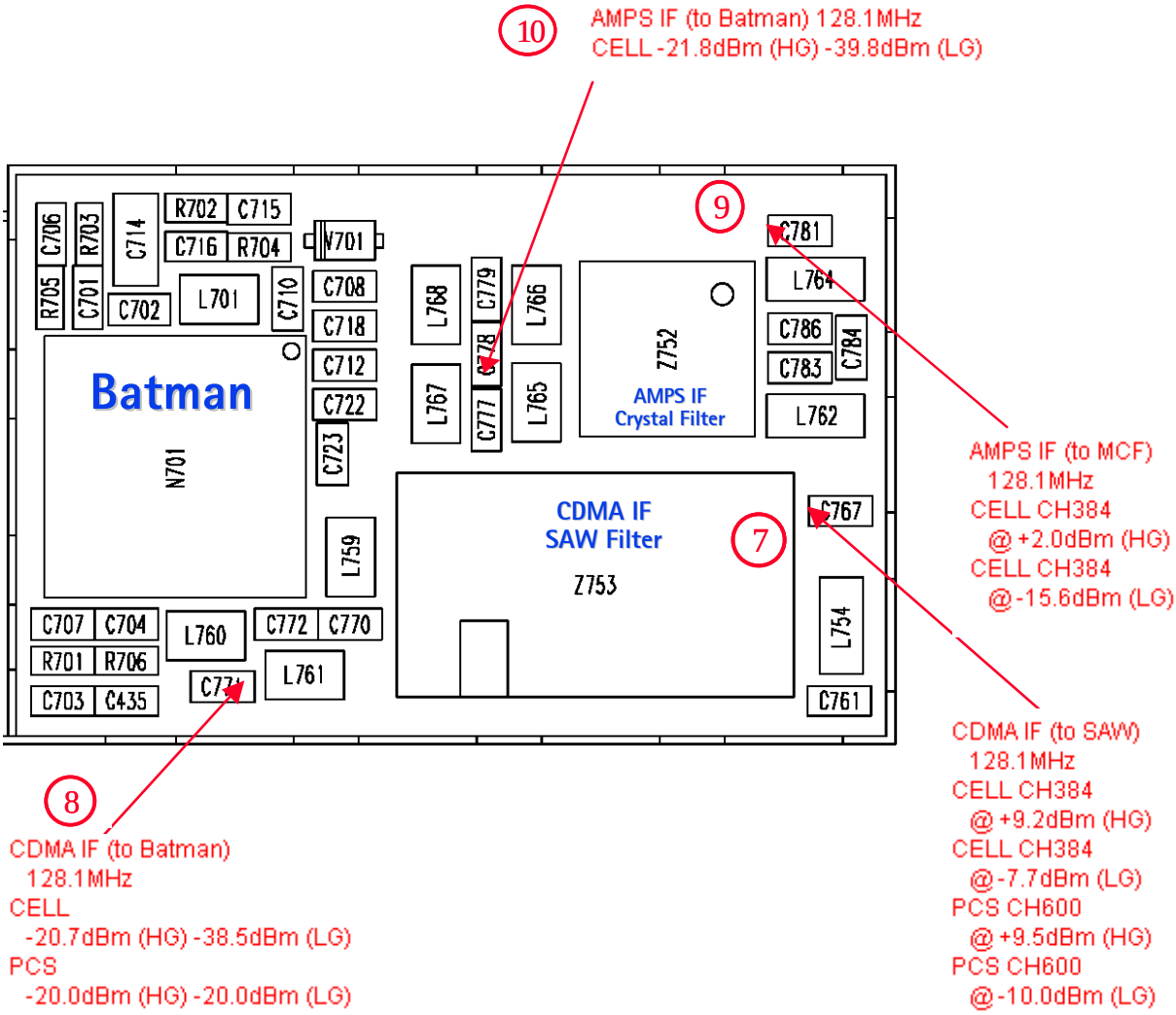
Receiver IF Troubleshooting Layout



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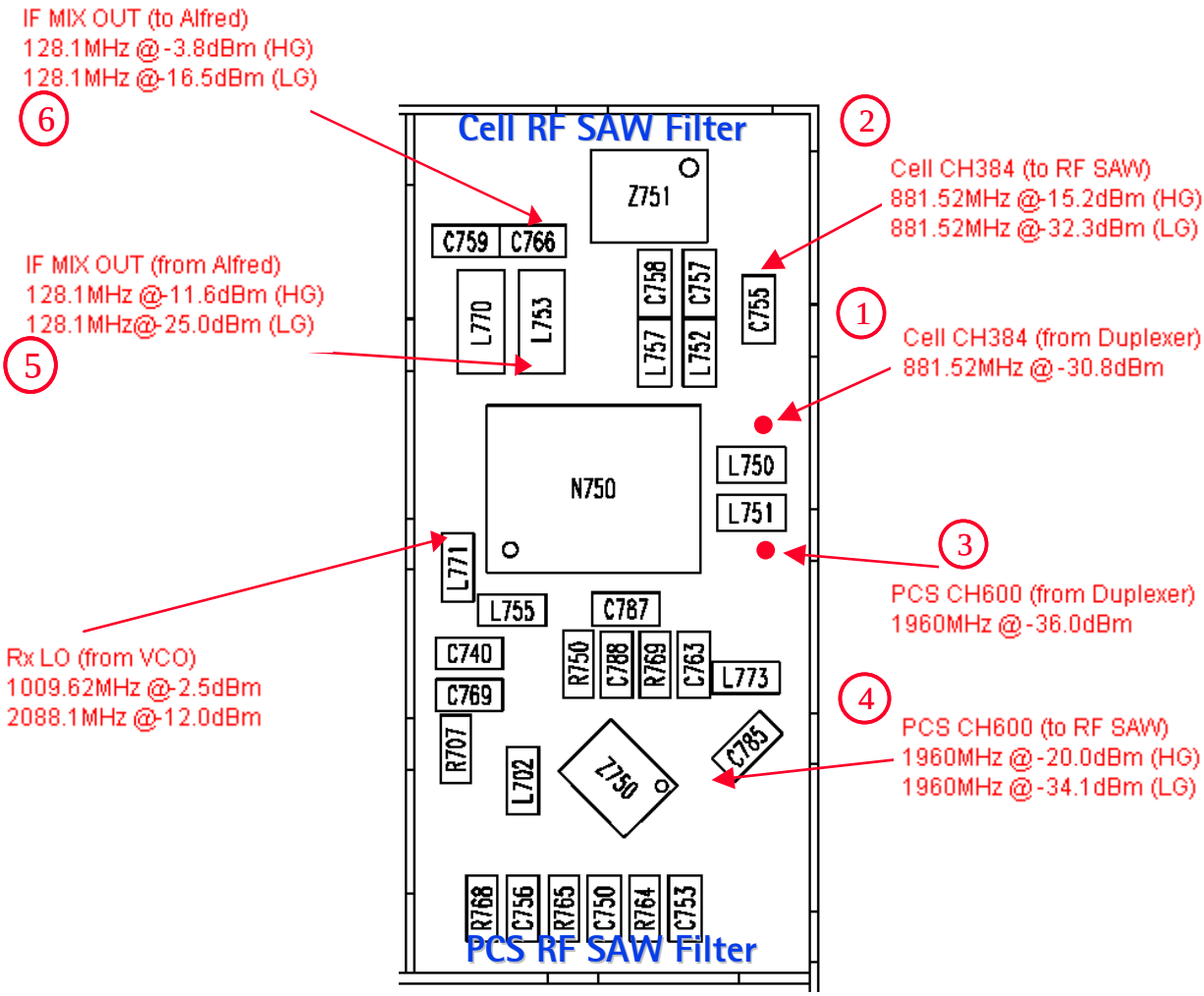
Receiver RF Troubleshooting Layout



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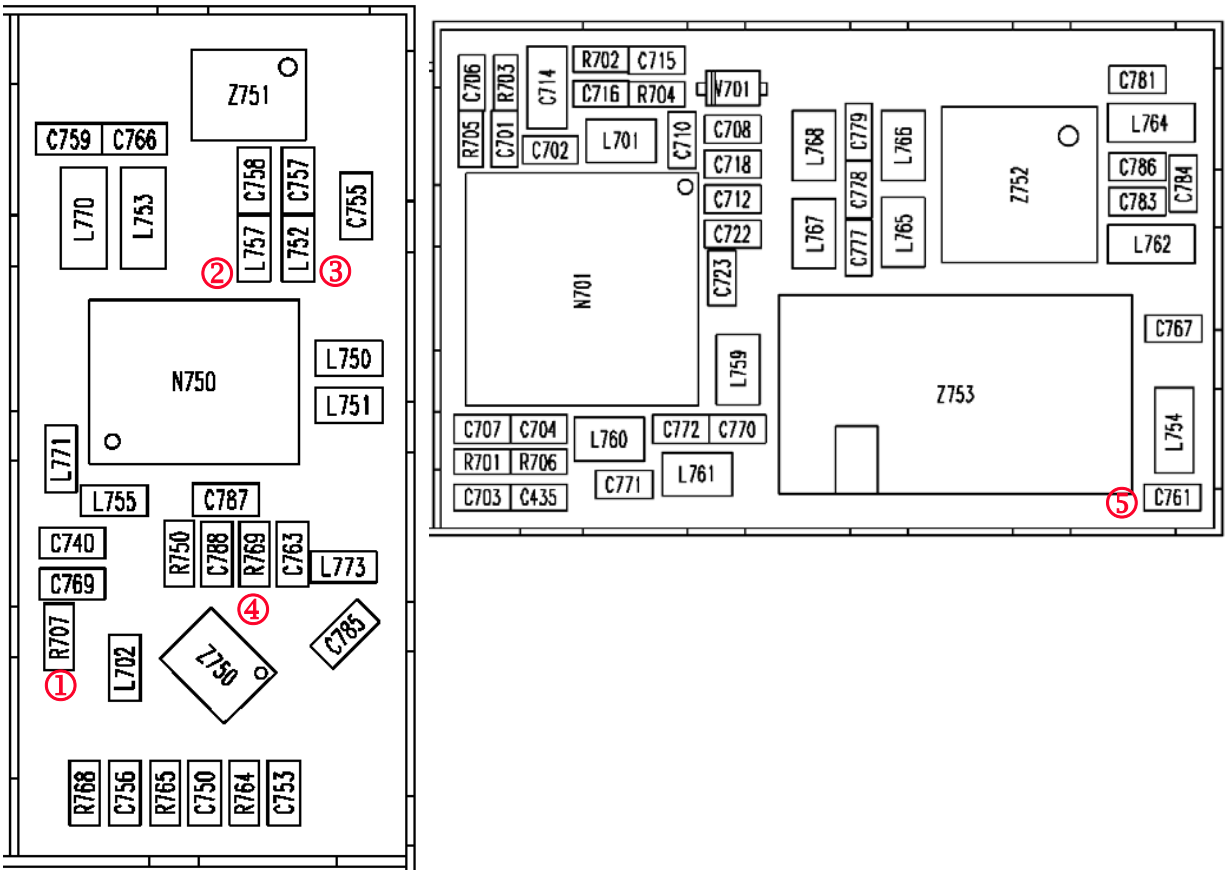
Receiver DC Troubleshooting Layout



① LO Vdd = 2.779VDC LOA Vdd supply lines for cell and PCS

② RFA Vdd = 2.779VDC RFA Vdd supply line for cell band

③ C_LNA Vdd = 2.779VDC External Vdd supply line for Cell LNA

④ P_LNA Vdd = 2.779VDC External Vdd supply line for PCS LNA

⑤ IFA Vdd = 2.779VDC IFA Vdd supply line for CDMA and AMPS IFs

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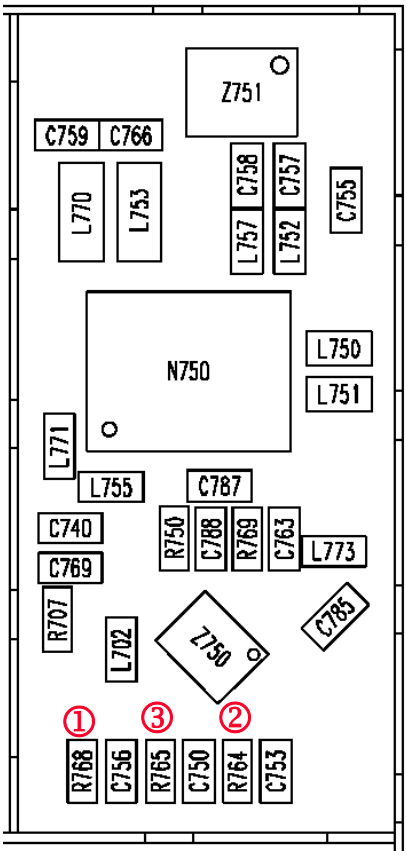
Receiver DC Troubleshooting Layout



Measure Logic Levels for Rx Front End (N750)

	LOGIC INPUTS VOLTAGES		
MODES	BAND ①	GAIN_CTL ②	IF_SEL ③
CELL CDMA HI-GAIN	0.1 V	2.75 V	0 V
CELL CDMA LOW-GAIN	0.1 V	0 V	0 V
PCS CDMA HI-GAIN	2.68 V	2.75 V	0 V
PCS CDMA LOW-GAIN	2.68 V	0 V	0 V
AMPS HI-GAIN	0.1 V	2.76 V	2.76 V
AMPS LOW-GAIN	0.1 V	0 V	2.76 V

Note: If logic levels are significantly off (+/- 0.2V), replace Alfred (N750) and remeasure. If voltages are still out-of-spec, consult *Troubleshooting - Baseband* section of this manual.

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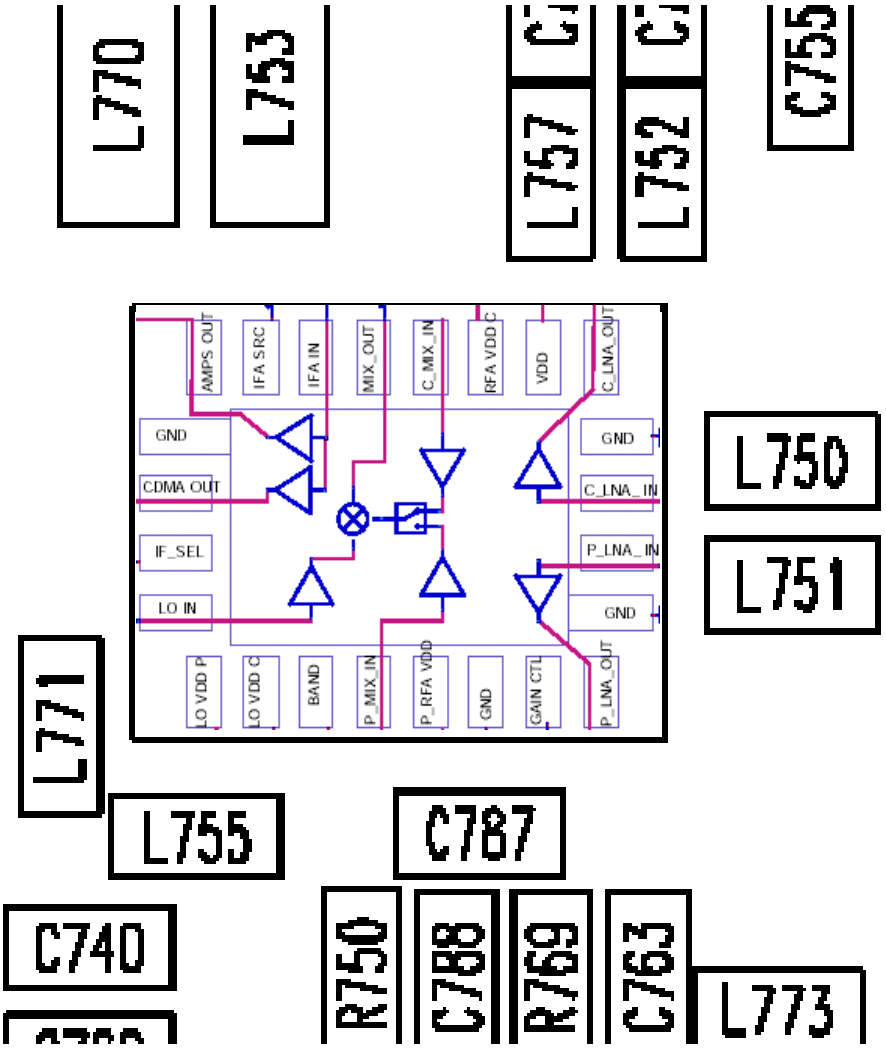
Alfred Receiver Troubleshooting



Things to Keep in Mind:

1 There is a separate LNA for 800MHz (Cell and AMPS) and 1900MHz (PCS).

2 Inside Alfred is the RFA again. There is a separate RFA for 800MHz (Cell and AMPS) and 1900MHz (PCS).

3 After RFA, there is a mixer and then the signals are separated by CDM (Cell and PCS) and AMPS.

4 For example, if there is no IF freq (128.1MHz), check both Cell and PCS. If only one has at 128.1MHz (L753), check IF_Sel is working. If it is, then replace Alfred (bad RFA).

5 If Cell and AMPS are working fine, but PCS is not, look at the band select line and the PCS LNA before replacing Alfred.

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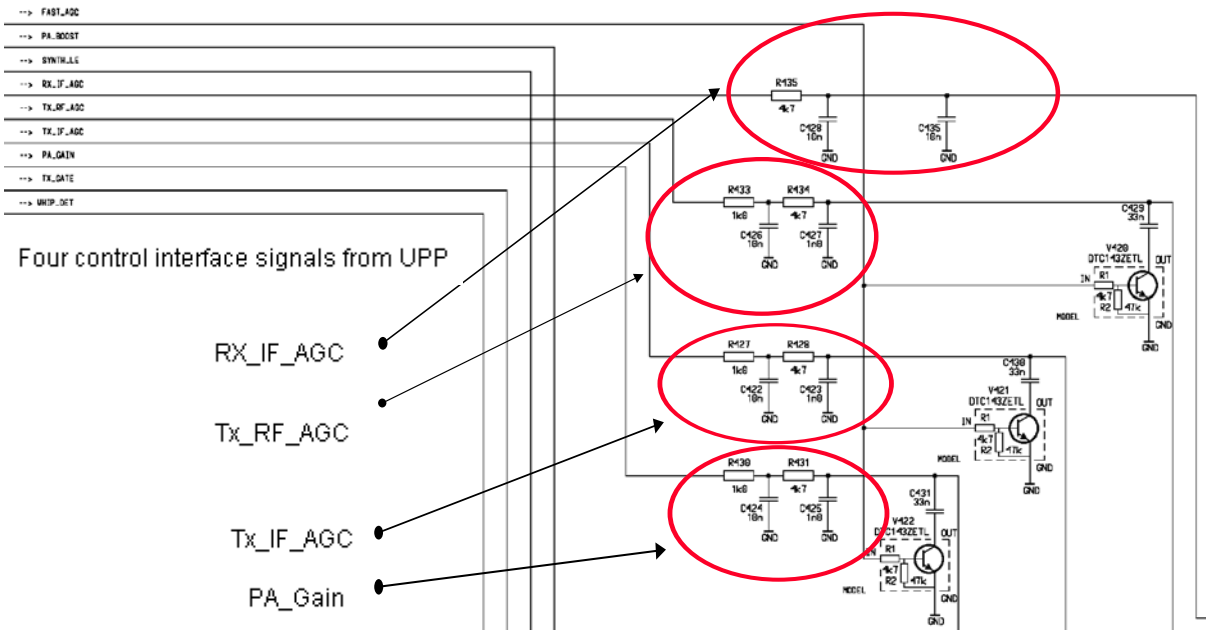
Receiver DC Troubleshooting Alfred

Eventually, you will run into an Alfred failure that has the symptoms of high current in local mode with just the Rx turned on. There can be two common explanations for this: (1) No presence of an LO signal, and (2) input impedance drop shorting out one of the DC supply pins to the chip. IMPORTANT: YOU MUST CHECK FOR BOTH CONDITIONS BEFORE REPLACING THE CHIP. If you have no LO signal, refer to the section of this chapter on troubleshooting the UHF LO. If you have a significant supply voltage drop on one of the supply pins, then change Alfred.

Condition (Local Mode, Set Rx only in RF Main Mode)	Supply Current (from power supply)
Good phone	104mA
No UHF LO Signal present	254mA
Pin 13 shorted	255mA

Control Signals at RF-BB Interface



NOTE: These components are located at the back panel. Check from SMD or missing components.

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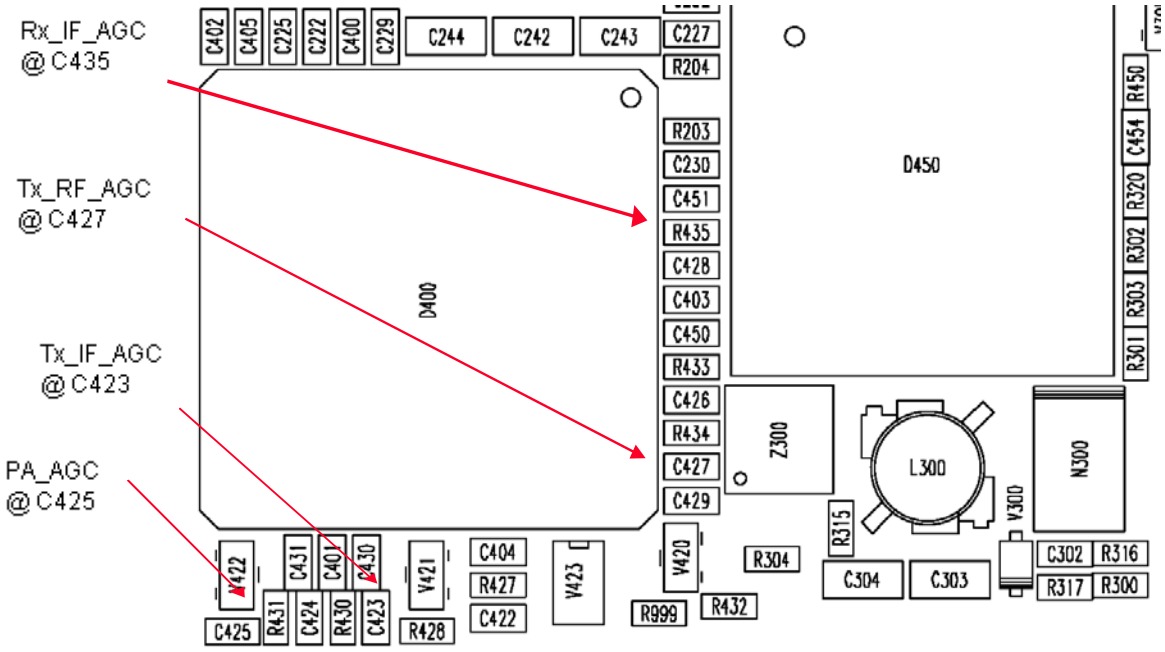
Back Panel Control Signals RF-BB Interface



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